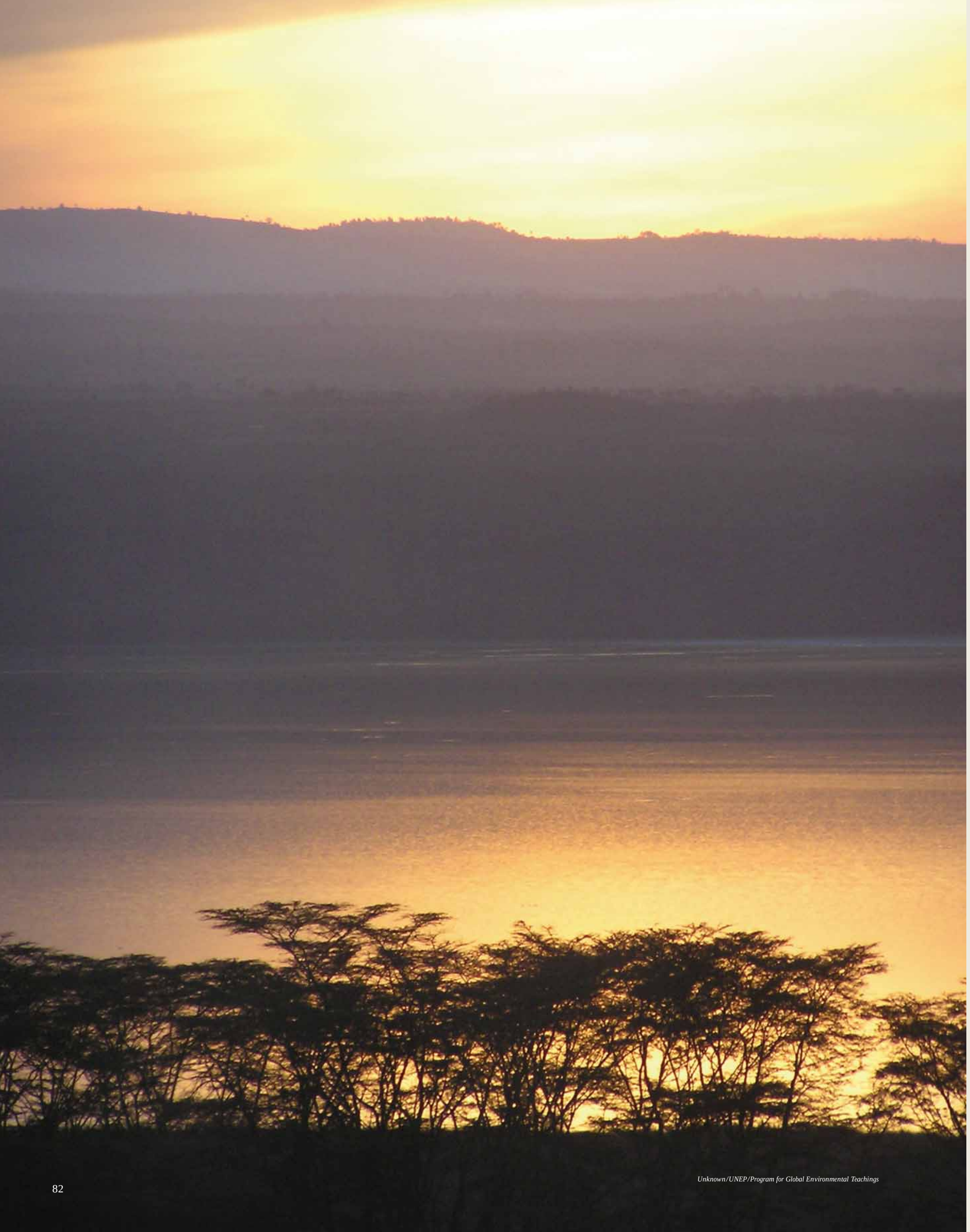

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Africa's Lakes
4 Epilogue

As shown in this Atlas, Africa's lakes contribute significantly to socio-economic development of the African region. Systematically, three main categories of values are distinguished: direct, indirect and symbolic values. The most obvious (direct) use of lakes is as a source for drinking water, irrigation, transportation, fishing and the water supply for households and industry. Additionally, water bodies are breeding grounds for migratory waterfowl and home to myriad species of flora and fauna. Indirect values imply water-retention mechanisms during flooding, impacts on local climate and sinks for wastewater discharges. Symbolic values include religious and spiritual purposes, and the references to water in the expressions of art.

However, these lakes are subject to high levels of rapid population growth, urbanization, industrialization, mining development, expansion of irrigated agriculture, and impacts of climate change. These pressures alter ecosystem processes and result in several threats on the lakes including: loss of biodiversity, over-fishing, eutrophication, proliferation of invasive weeds, siltation, toxic contamination and over-abstraction of water. It is important to note water systems are sensitive barometers of the health of our planet. While water covers most of the earth's surface, only about two per cent of the water body consists of freshwater—and most of that is bound in polar icecaps. Freshwater in a liquid state is, indeed, very scarce. Greatly aggravating the problem is the fact that a great part of the world's available freshwater is concentrated in a relatively few large lakes, many of which are shared by two or more countries. At the same time lakes are a source of livelihoods for most African communities yet there is a lot of mismanagement and over utilization of these water bodies in Africa. African lakes are also subject to climatic change despite human-induced pressures. Lakes in Africa are avenues of economic development. They are also sources of diseases if they are not sustainably managed.

In the years since United Nations Conference on Environment and Development (UNCED), the importance of lakes as invaluable natural resources has increasingly been acknowledged. For instance, water is identified as a central issue in the Millennium Development Goals, a set of time-bound and measurable goals and targets for combating various environmental and development problems adopted by heads of state gathered at the UN Millennium Summit in September 2000. Water resource management has also come high on the agenda at the World Summit on Sustainable Development (WSSD) held in Johannesburg in September 2002 (Rio +10). One of its major output documents agreed to by the participating governments, the Plan of Implementation, calls for a number of immediate actions for the promotion of integrated water management. The importance of management of tranboundary water systems has also been explicitly and concretely recognized by the international community, as signified by the establishment of the Convention on the Law of the Non-navigational Uses of International Watercourses. Although there is a lot said about lakes as avenues for development, little has been done to assess the impact of human influence on these lakes. There is a need to monitor and evaluate the changes and pressure exerted in humanity as a way to map out sustainable management of this water bodies. The use of satellite imagery is one of the modern ways that we can use to show and map out the changes experienced in most African lakes. The imagery can show changes over different time periods and have a wide coverage. The use of geographic information systems (GIS) and remote sensing technology are powerful tools for monitoring, management, modeling and evaluation of environmental impacts. These tools, as illustrated in this Atlas, will help policymakers develop informed decisions on management of African lakes and their related ecosystems.

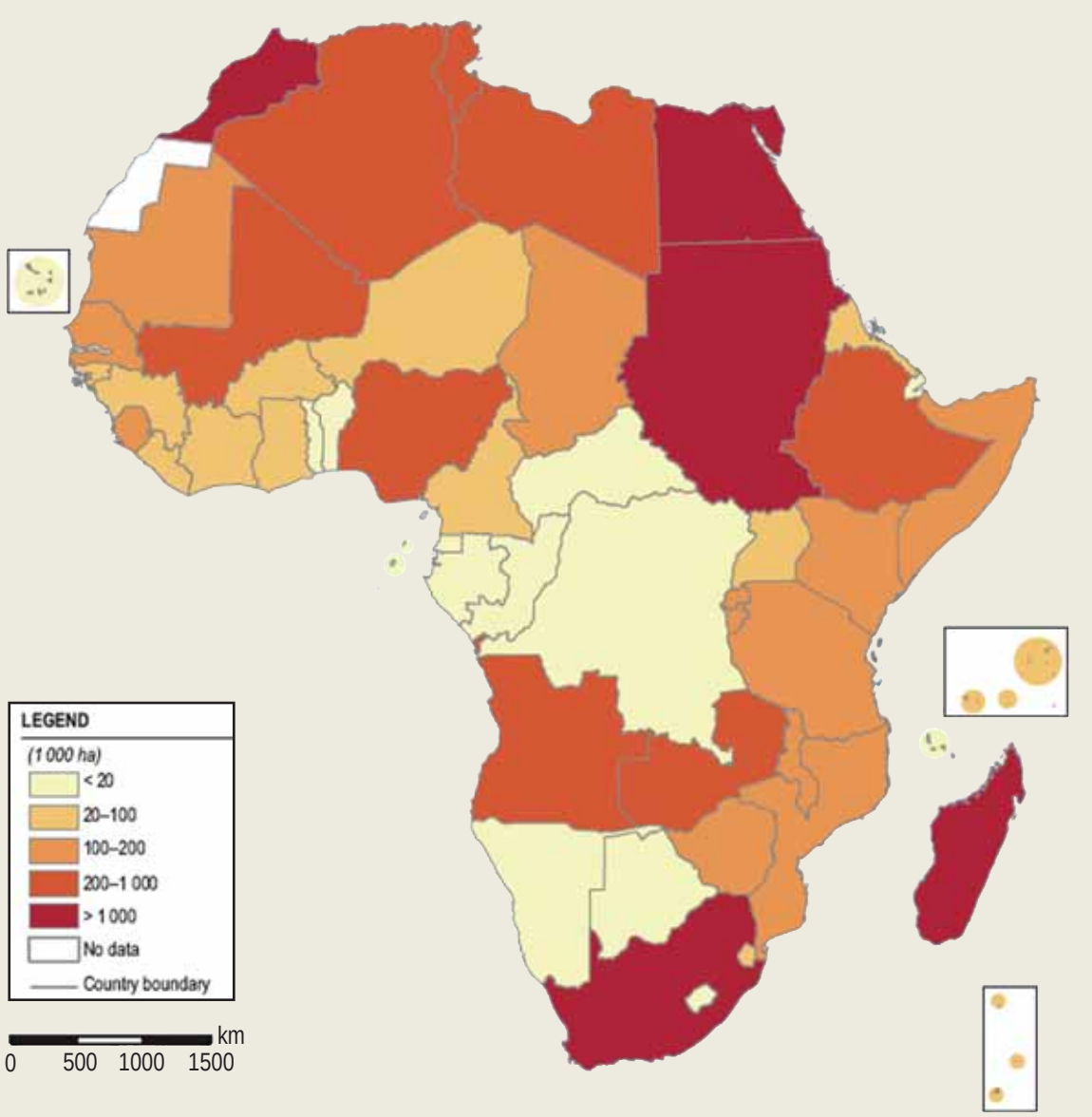

Figure 4.1: Water managed areas

FAO 2005

Appendix: Some principle lakes, reservoirs, and lagoons of Africa. (Those highlighted are illustrated case studies in this Atlas).

Name	Country	Longitude	Latitude	Altitude [m]	Surface area [km^2]	Maximum depth [m]	Length of shore-line[km]	Volume [km^3]	Mean depth[m]
A el- Gsebaia, Lake	Libya	24.70E	29.61N						
Abaya, Lake (formerly Lake Margherita)	Ethiopia	37.4E	6.1N	1,285	1,160	7	13	8.2	225
Abe, Lake	Djibouti, Ethiopia	41.45E	11.10N	310	780				
Abhe, Lake	Ethiopia	41.4E	11.1N	243	320	8.6	37	3	
Abijata, Lake	Ethiopia	38.4E	7.3N	1,573	205	7.6	13	0.75	205
Aby Lagoon	Cote d'Ivoire	3.08W	5.15N	1	780				
Afambo Hayk, Lake	Ethiopia	41.71E	11.41N						
Afrera ye'ch'ew, Lake	Ethiopia	40.94E	13.29N		100				
Aheme, Lake	Benin	1.95E	6.47N						
Al Massira, Lake	Morocco	7.56W	32.46N		141			2.76	
Al Wahda, Lake	Morocco	5.34W	34.77N		123			3.8	
Alaotra, Lake	Madagascar	48.5E	17.5S		200		4		
Albert, Lake	DR Congo, Uganda	30.5E	1.4N	615	5,300	25	58	280	
Allemanskraal, Lake	South Africa	27.23E	28.34S						
Am 'Abd et Gabbar, Lake	Egypt	25.33E	29.26N						
AManzamnyama, Lake	South Africa	32.84E	27.06S						
Amaramba, Lake	Mozambique	35.93E	14.49S						
Ambadi, Lake	Sudan	29.32E	8.66N						
Ambendrana, Lake	Madagascar	48.84W	13.57S						
Aougoundou, Lake	Mali	3.33W	15.71N		100				
Asejire, Lake	Nigeria	4.1E	73N	137	15		19		
Atuo, Lake	Ethiopia	34.26E	7.61N						
Awassa, Lake (Awasa, Awusa)	Ethiopia	38.2E	7.0N	1,708	129	11	22	1.3	52
Ayame, Lake	Cote d'Ivoire	3.20W	5.75N		150				
Bahi, Lake	Tanzania	35E	6S						
Bamendjin, Lake	Cameroon	10.55E	5.83N		400				
Banda Nwanta, Lake	Ghana	2.25W	8.33N		180				
Bangweulu, Lake (Bangweolo)	Zambia	29.45E	11.05S	1,140	15,100	4	10	148	490
Banyoles, Lake	Zambia	2.4E	42.1N	175	1.12	14.8	46.4	0.0161	9.13
Bardawil, Lake	Egypt	33.08E	31.08N		5,390				
Baringo, Lake	Kenya	36.63E	0.61N		108	2.5	3.5	0.73	
Barombi-Mbo, Lake	Cameroon	9.39E	4.66N						
Beda, Lake	Ethiopia	40.41E	9.90N						
Bemamba, Madagascar	Madagascar	44.39W	18.89S						
Bisina, Lake	Uganda	33.98E	1.65N		150				
Bloemhofdam, Lake	South Africa	25.67E	27.67S		300			0.56	
Bogoria, Lake	Kenya	36.1E	0.25N	960	34	5.4	10	0.18	
Botsumtwi, Lake	Ghana	1.42W	6.50N		49	45	81		
Burigi, Lake	Tanzania	31.29E	2.06S		100				
Burullus, Lake	Egypt	30.83E	31.50N		350				
Buyo, Lake	Cote d'Ivoire	6.98W	6.64N		989			8.3	
Cahora Basa Reservoir	Mozambique	31.4E	15.4S	314	43,63	20.9	157	55.8	246
Calueque, Lake	Angola	14.63E	17.22S		250				
Chad, Lake	Chad, Cameroon, Niger, Nigeria	14.17E	13.2N	280	1,540	4.1	10.5	72	650
Challawa Gorge Reservoir	Nigeria	6.9E	10.0N		101			0.10	
Chamo, Lake	Ethiopia	37.57 E	5.83 N	1,235	551		13		118
Chilwa, Lake (Shilwa)	Malawi, Mozambique	35.72E	15.33S	622	1,750	1	2.7	1.8	200
Chishi, Lake	Zambia	29.78E	8.90S		1,000				

Name	Country	Longitude	Latitude	Altitude [m]	Surface area [km^2]	Maximum depth [m]	Length of shore-line[km]	Volume [km^3]	Mean depth[m]
Chiuta, Lake	Malawi, Mozambique	35.87E	14.8S		100				
Chott el-Hodna, Lake	Algeria	4.67E	35.30N	400	3,620				
D'Afennourir, Lac	Morocco	5.17W	33.33N						
Darlington (Mentz), Lake	South Africa	25.15E	33.17S		40				
De Hoop Vlei, Lake	South Africa	20.38E	34.49S						
Debo, Lake	Mali	4.10W	15.32N		100				
Densu Reservoir (Weija)	Ghana	0.35W	5.55N	14.1	2,564		15.6		
Djoudj, Lake	Senegal	16.2W	16.33N	0	160				
Do, Lake	Mali	2.92W	15.88N		150				
Dziani Boundouni, Lake	Comoros	43.75E	12.35S		0.3				
Ebrie, Lake	Cote d'Ivoire	4.26W	5.30N		589				
Edward, Lake	DR Congo, Uganda	0.42 E	29.58 N	912	2,325	17	112	39.53	
Elmenteita, Lake	Kenya	36.26 E	0.44 S	1,776	20	0.9	1.2		
Er Rosieres, Lake	Sudan	34.42E	11.67N		450				
Eyasi, Lake	Tanzania	35.07 E	3.60 S		1,200				
Faguibine, Lake	Mali	4.00W	16.75N	280	590		10	4	
Fetzara, Lake	Algeria	7.53E	36.78N						
Finch'a', Lake	Ethiopia	37.18E	9.50N		200				
Fitri, Lake	Chad	17.43E	12.90N		100				
Garou, Lake	Mali	2.79W	16.04N		150				
Gemeri, Lake	Ethiopia	41.69E	11.54N						
George, Lake	Uganda	30.21E	0.00	914	250	2.4	4.5	0.8	
Gessi, Lake	Ethiopia	34.20E	7.65N						
Gove, Lake	Angola	15.83E	13.42S		300				
Grand Lahou, Lake	Cote d'Ivoire	5.26W	5.17N		199				
Great Bitter Lake	Egypt	32.39E	30.37N		200				
Guiers, Lake	Senegal	15.83W	16.25N	0	228	1.3	2.5	0.415	150
Hartbeespoort Dam Reservoir	South Africa	27.86 E	25.78 S		20	9.6			
Hayq, Lake	Ethiopia			2,030	35		23		
Hendrik Verwoerd, Lake	South Africa	25.67E	30.67S		400				
Ichkeul, Lake	Tunisia	9.67 E	37.17 N		126	1	2		
Idriss, Lake	Morocco	4.65W	34.14N		40			1.19	
Ihema, Lake	Rwanda	30.78E	1.88 S	1,291	90	4.8	7.8	512.6	78
Ihotry, Lake	Madagascar	43.67E	21.92S		100				
Iro, Lake	Chad	19.42E	10.10N		100				
Ist'Ifanos (Chew Bahir), Lake	Ethiopia	36.95E	4.72N		300				
Jebba, Lake	Nigeria	4.75E	9.25N		360			1.0	
Jebel Aulia, Lake	Sudan	32.22E	14.73N		398				
Jipe, Lake	Kenya,Tanzania								
Kabamba, Lake	DR Congo	27.03E	7.92S		150				
Kabele, Lake	DR Congo	25.95E	8.93S		100				
Kabwe, Lake	DR Congo	26.03E	9.17S		100				
Kachira, Lake	Uganda	31.13E	0.57S		46				
Kafue Reservoir	Zambia	28.37E	15.81S		1,500			20.3	
Kainji Reservoir	Nigeria	4.55E	10.40N		1000				
Kampolombo, Lake	Zambia	29.4E	11.33S		150				
Kanyaboli, Lake	Kenya				11	3			
Kariba, Lake	Zambia, Zimbabwe	27.5E	16.79S	485	54	31	78	160	2164
Kifukula, Lake	DR Congo	28.53E	9.76S		100				
Kikuletwa, Lake	Tanzania	37.42E	3.67S		200				
Kinkony, Lake	Madagascar	45.83E	16.15S		100				
Kioga, Lake (Kyoga)	Uganda	33.1E	1.4N	914	1,720		5.7	6.21	

Name	Country	Longitude	Latitude	Altitude [m]	Surface area [km^2]	Maximum depth [m]	Length of shore-line[km]	Volume [km^3]	Mean depth[m]
Kisale, Lake	DR Congo	26.45E	8.25S		200				
Kitangiri, Lake	Tanzania	34.33E	4.08S		100				
Kivu, Lake	Rwanda, DR Congo	29.26W	2S	1,460	2,220	240	480	333	
Koka, Lake	Ethiopia	39.1E	8.3N	1,590	250	9.14	13	0.01	
Komango, Lake	Mali	3.69W	16.5N		200				
Kompienga, Lake	Burkina Faso	0.63E	11.16N		220			2.00	
Korarou, Lake	Mali	3.28W	15.30N		100				
Kossou, Lake	Cote d'Ivoire	5.58W	7.17N		1,500				
Kouilou, Lake	DR Congo	12.44E	3.55S		874			35	
Kyle, Lake	Zimbabwe	31E	20.23S		100				
La Vallee d'Iherir Lakes	Algeria	8.25E	25.24N						
Lagdo, Lake	Cameroon	13.97E	8.88N		586			7.70	
Lagos, Lake	Nigeria	3.66E	6.52N		378				
Langana, Lake	Ethiopia	38.62E	7.62N		170				
Lesotho Highlands Reservoirs	Lesotho	28.52E	29.33S						
Liambezi, Lake	Namibia	24.33E	17.90S						
Magadi, Lake	Kenya	36.27E	1.87S		200		1	0,05	
Mai-Ndombe, Lake (Lake Leopld II)	DR Congo	18.20E	2S	340	8,210	5	12	41	
Malawi, Lake (formerly Lake Nyasa or Niassa)	Malawi, Mozambique, Tanzania	34.5E	0.1S	500	29,500	292	706	7,775	245,000
Malombe, Lake	Malawi	35.25E	14.67S		300				
Manambolomaty Lake Complex	Madagascar	44.24E	19.1N		7,491				
Manantali, Lake	Mali	10.50W	13N		200				
Manyara, Lake	Tanzania	35.83E	3.58S		500				
Manzala, Lake	Egypt	32E	31.15N	<1	1,360				
Mape, Lake	Cameroon	11.31E	6.18N		520			3.20	
Marais de Toumbos	Mauritania	16.33W	16.83N		200				
Mare aux hippopotames	Burkina Faso	4.7W	11.37N						
Mare d'Oursi	Burkina Faso	0.30W	14.30N						
Mariout, Lake	Egypt	29.90E	31.12N		66			0.98	
Massinger Barragen, Lake	Mozambique	32.08E	23.87S		150				
Mcilwaine, Lake	Zimbabwe	30.5E	17.5S	1,364	26	9.4	27.4	0.25	74
Mita Hills, Lake	Zambia	29.09E	14.1S		47			0.67	
Mohammed V, Lake	Morocco	2.93W	34.63N		32			0.73	
Monoum, Lake	Cameroon	10.58E	5.58N						
Mweru Wantipa, Lake	Zambia								
Mweru, Lake	Zambia, DR Congo,	28.45E	9S	922	4,350		37	33	340,000
Mylius, Lake	Ethiopia	36.84E	7.07N						
Naivasha, Lake	Kenya	36.2E	0.5S	1,890	160	6.5	11.5	4.6	68
Nakivale, Lake	Uganda								
Nakuru, Lake	Kenya	36.1E	0.2S	1,759	40	2.3	2.8	0.092	27
Nasser, Lake	Egypt, Sudan	32.1E	22.6N	183	5,248	25.2	130	132.5	7,844
Natron, Lake	Kenya, Tanzania	36.1E	2.15S		600			0.35	
Ngami, Lake	Botswana	22.77E	20.5S		120				
Ngobe, Lake	Gabon	9.50E	1.98S		209				
Niangay, Lake	Mali	3.22W	15.83N		300				
Nokoue, Lake	Benin	2.45E	6.42N		150				
Nubia, Lake	Sudan	30.4E	21.1N	183	968			24.4	1,406
Nyos, Lake	Cameroon	10.18E	6.27N						
Nzilo, Lake	DR Congo	25.70E	10.88S		280				

Name	Country	Longitude	Latitude	Altitude [m]	Surface area [km^2]	Maximum depth [m]	Length of shore-line[km]	Volume [km^3]	Mean depth[m]
Oguta, Lake	Nigeria						8		
O'Higgins, Lago-San Martin	Nigeria	72.1W	48.5S	250	1,058				525
Oiseaux, Lac des	Algeria	8.7E	36.47N						
Okavango Delta	Botswana	22.02E	18.59S						
Onangue, Lake	Gabon	10.05E	1.01S		254				
Oponono, Lake	Namibia	15.30E	19.15S						
Oro, Lake	Mali	3.88W	16.25N		100				
Parc national des Virunga	DR Congo	29.30E	1.15S						
Petit Loango	Gabon	9.45E	2.15S		120				
Piso, Lake	Liberia	11.15W	6.45N		760				
Poelela, Lake	Mozambique	35.08E	24.53S		100				
Pongolapoort, Lake	South Africa	31.96E	27.41S		58			2.45	
Pool Malebo, Lake	DR Congo	15.42E	4.25S		300				
Quiminha, Lake	Angola	13.71E	8.99S		36			1.56	
Quran, Lake	Egypt	30.61E	29.45N		200				
R.K.Roux, Lake	South Africa	24.88E	30.17S		150				
Retenue de la Lufira	DR Congo	27.03E	10.92S		200				
Revue, Lake	Mozambique	33.08E	19.13S		200				
Rkiz, Lake	Mauritania	15.33W	16.83N		150				
Rudolf, Lake	Ethiopia, Kenya	36E	3.30N	427	6,400	7	73	187	340
Rukwa, Lake	Tanzania	32.25E	8S	793	3,000		1		
Rweru, Lake	Burundi	30.32E	2.38S		100				
Selingue, Lake	Mali	8.25S	11.50N		200				
Shala, Lake	Ethiopia	38.4E	7.3N	1,558	329	87	266	36.7	
Shamo, Lake	Ethiopia	37.40E	5.50N	1235	550		13		
Shiroro, Lake	Nigeria	6.91E	9.97N		312			7.0	
Sibaya, Lake	South Africa	32.2E	27.2S	23	78	12.6	43	0.981	126.9
Songor Lagoon	Ghana	0.30E	5.45N						
St. Lucia, Lake	South Africa	32.30E	28S		300		8		
Sterkfontein, Lake	South Africa	29.03E	28.47S		83			2.62	
Tana, Lake	Kenya	37.46E	0.87S		159			1.56	
Tana, Lake (2)	Kenya	37.50E	0.88N		250				
Tana, Lake (Tsana)	Ethiopia	37.2E	11.4N	1,788	3,600	9	14	28	385
Tanda, Lake	Mali	4.72E	15.75N		100				
Tanganyika, Lake	Tanzania, Zambia, Burundi, DR Congo	30.1E	6.0S	773	32,000	572	1,471	17,800	1,900
Tonga, Lake	Algeria	8.31E	36.53N			2			
Toshka Project, Reservoirs	Egypt	30.52E	23.13N						
Tsimanampetsotsa, Lake	Madagascar	43.48E	24..13S	114	456				
Tumba, Lake	DR Congo	18.00E	0.83N	340	500		5		
Turkana, Lake (Lake Rudolf)	Ethiopia, Kenya	36.1E	3.3N	360	6.750	30.2	109	203.6	
Turkwel, Lake	Kenya	35.14E	1.71N		37			1.6	
Tuska Lakes	Egypt	23.08E	30.87N		200				
Upemba, Lake	DR Congo	26.40E	8.67S	580	450		4	0.9	
Vaaldam, Lake	South Africa	28.33E	27S		400				
Velorenvlei, Lake	South Africa					2.5	5		
Victoria, Lake	Tanzania, Uganda, Kenya	33.1E	1.4S	1,134	68,800	40	84	2,750	3,440
Volta, Lake	Ghana	1E	7.4N	85	8,502	18.8	75	148	4,800
Zeekoevlei, Lake	South Africa	18.4E	34.0S	5	3	1.9	5.2	0.005	12.6
Zimbambo, Lake	DR Congo	26.87E	8.17S		150				
Ziway, Lake	Ethiopia	38.4E	7.5N	1,636	485	2.5	9	1.1	102

Source: LakeNet http://www.worldlakes.org/searchlakes.asp

Acronyms and Abbreviations

AIDS	Acquired Immunisation Deficiency Syndrome
AVISO	Archiving Validation and Interpretation of Satellite Oceanographic Data
BAR	Basin at Risk
˚C	degree Centigrade
CIESIN	Center for International Earth Science Information Network
cm	Centimetres
CNPPA	Commission on National Parks and Protected Areas
CO	Carbon monoxide
CO_2	Carbon Dioxide
CRED	Center for Research on the Epidemiology of Disasters
CRU	The Climate Research Unit
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSR	Climatological Solar Radiation
DEWA	Division of Early Warning and Assessment
DR	Democratic Republic
DDT	Dichlorodiphenyltrichloroethane
E	East
EROS	Earth Resources Observation and Science (National Center)
ETM	Enhanced Thematic Mapper (ETM+).
FAO	Food and Agriculture Organization of the United Nations
FEWS	Famine Early Warning Systems
ft	Foot / Feet
GDP	Gross Domestic Products
GEF	Global Environment Facility
GEO3	Global Environmental Outlook Report 3 (UNEP Publication)
GHG	Greenhouse Gas
GIS	Geographic Information System
GLC	Global Land Cover
GLCF	Global Land Cover Facility
GPS	Global positioning system
GPW	Gridded Population of the World
GRDC	Global Runoff Data Center
GRID	Global Resource Information Database
GWP	Global Water Partnership
HIV	Human Immunodeficency Virus
H_2O	Water - Hydrogen dioxide
ha	Hectares
HCO_3	Carbonic Acid
ICRAF	International Centre for Research in Agroforestry
ICE	Inventory of Conflict and Environment
ILEC	International Lake Environmental Committee
IRN	International Rivers Network
IPC	International Programs Center, United States Census Bureau, Population Division
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature and Natural Resources
kg	kilogrammes
km	kilometres
km^2	square kilometres
km^3	cube kilometres
LVEMP	Lake Victoria Environmental Management Project Phase
LHWP	Lesotho Highlands Water Project
m	metres
MDG	Millennium Development Goal
mm	Milllimetres
MODIS	Moderate Resolution Imaging Spectroradiometer

MOPITT–MRS	Measurements Of Pollution In The Troposphere–Metropolitan Region of Santiago
MSS	Multispectral scanner
Mt.	Mount
n.d.	Not dated
N	North
N_2	Nitrogen
N_2O	Nitrogen dioxide
NASA	National Aeronautics and Space Administration
NEPAD	New Partnership for Africa's Development
OFDA	Office of U.S. Foreign Disaster Assistant
OMVS	Organization pour la Mise en Valeur du Fleuve Senegal
OWF	Our World Foundation
S	South
SADC	Southern Africa Development Community
SAED	Delta Improvement and Exploitation Society
SAIC	Science Applications International Corporation
SARDC	Southern African Research and Documentation Centre
SOFIA	Stratospheeric Observatory For Infrared Astronomy
T/P	TOPEX/POSEIDON
TBR	Transboundary Biosphere Reserve
TFDD	Transboundary Freshwater Dispute Database
TM	Thematic Mapper
UMD	Universal Mutation Database
UN	United Nations
UN-DHA	United Nations, Department of Humanitarian Affairs
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organization
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNF	United Nations Foundation
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
UNICEF	United Nations International Children Emergency Fund
USAID	United States Agency for International Development
USGS	United States Geological Survey
W	West
WB	World Bank
WCMC	World Conservation Monitoring Center
WHO	World Health Organization
WMO	World Meteorological Organization
WRI	World Resources Institute
WSSD	World Summit on Sustainable Development
WWF	World Wildlife Foundation

ETM/LANDSAT Equipped with high resolution instruments, Landsat- 7 was successfully launched on 15 April 1999. This satellite carries the Enhanced Thermal Mapper Plus (ETM+), which is an eight-band, multispectral scanning radiometer. The ETM+ is capable of resolving distances of meters in the panchromatic band; 30m (98 feet) in the visible, near and short-wave infrared band; and 60m (197 feet) in the thermal infraredband.

LANDSAT On 23 July 1972, NASA launched the first in a series of satellites designed to provide repetitive global coverage of the Earth's land masses. It was designated initially as the 'Earth Resources Technology Satellite-A'. The second in this series of Earth resources satellites (designated 'ERTS-B') was launched on 22 January 1975. It was renamed 'Landsat 2' by NASA, which also renamed 'ERTS-1' as 'Landsat 1'. Four additional Landsats were launched in 1978, 1982, and 1999 (Landsat 3, 4, 5 and 7), respectively.

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